9S52 "POLYANA-D4" automated control system of combat operations

The development of an automated control system for combat operations of an anti-aircraft missile brigade armed with a S-300V or Buk anti-aircraft system (code Polyana-D4, index 9C52) was conducted on the basis of decisions of the Commission of the Presidium of the USSR Council of Military-Industrial Affairs of June 29, 1977. and from August 27, 1981 according to the TTZ GRAU and its addendum. N. A. Solosin, K. D. Mirzoev, A. P. Dergachev, Yu. V. Ugolkov, G. A. Stepanov, A. A. Chuikin, Yu. N. Sheremetyev, A. G Luzan and other employees of the Main Agrarian University of Ukraine, 3 research institutes of the Ministry of Defense and the Directorate of the Chief of the Air Defense Forces.

The development of the automated control system "Polyana-D4" was conducted by the Research Institute of Automation Equipment of the Ministry of Radio Industry. The chief designer of this automated control system was G. A. Burlakov.

The main purpose of the AMS 9S52 was the automated solution of the tasks of planning and organizing combat operations of the above-mentioned anti-aircraft missile brigades and the automated management of these actions while repelling the massed aerodynamic attacks and enemy ballistic EHF strikes.

Composition

The command and control station (MP06M vehicle) of the Polyana-D4M ASU on the BAZ-6950 chassis Command and Staff Machine (MP02M machine) on the Ural-375 chassis of the Poliana-D4M automated command and control system.

The structure of the ACS "Polyana-D4" included: command and control center (PBU) of the brigade (machine MP06); command and control vehicle (KSHM) of the brigade (MP02 machine with KP4 trailer); spare parts and technical maintenance machine (MP45 machine); two diesel power ED-T400-1RAM. The MP06, MP02 and KP4 trailers were significantly unified with the machines used at the air defense command post of the front (army) as part of the front-end anti-personnel system.

For the organization of the necessary external relations with all the mating objects, the system was attached to a mobile communication node.

The PBU was equipped with automated workplaces (AWP) of the brigade commander, senior military command and control officer (sent to two divisions and the air defense command post of the front (army), Air Force officer, operational duty officer, military command officer (sent to two divisions), intelligence chief brigade (senior operator processing radar information), operator processing radar information, engineer and technician-signalman.

The KSHM was equipped with an automated workplace for the deputy armament brigade commander, operational department officer (alphanumeric display operator - ATSD), senior operational department officer (drawing machine graphic operator - PGA) and non-automated workplaces for two technicians.

In the KSHM trailer were the AWS of the brigade chief of staff and the head of the operational department (brigade communications chief) - the ATSD operator and six non-automated jobs for brigade staff officers.

To ensure the combat operation of the Poliana-D4 ACS with higher-level, subordinate and interacting command centers and command and control points, exits to the assigned communications center were

provided for the exchange of operational-tactical and radar information (OTI and RI) using telecode channels, and for negotiating radio telephone channels.

Information exchange between PBU and KSHM with a trailer was carried out via cable communication lines and data transmission. To ensure communication on the march, radio stations were installed in the cabins of the MP06, MP02 machines with a trailer, MP45 and in power stations.

The vehicle BAZ-6950 with the SKN-6950 body was used as a transport base for the PBU. The CSR equipment was located in the back of the Ural-375 and in the back of the SMZ-782B trailer. The power plants were located in the car body KAMAZ-4310. The deployment time (coagulation) of the Polyana-D4 ACS by the calculation forces did not exceed 20 minutes.

Principles of combat use

The control objects for the ACS were: up to four anti-aircraft missile battalions armed with S-300V or Buk ("Buk-M1") air defense missile systems and their subsequent modifications; control point (PORI-P2 or PORI-P1) RLP, which was part of the command brigade; point of control of means of direct protection of crews - PU-12M or UBKP "Ranzhir".

The higher-level defense command posts in relation to the 9S52 ACS were the anti-aircraft defense command posts of the front or the army. Provision was made for the conjugation of the ASU 9S52 and the tactical unit of the tactical formation of the Air Defense Forces (of the country) "Luch" ("Pyramid"). Sources of information about the air situation for the ACS "Polyana-D4" were:

PU RLP PORI-P1 (PORI-P2); Aviation complex of the radar watch and guidance (AK RLDN) A-50; KP anti-aircraft missile battalions S-300V (KP 9S457) or "Buk" (KP 9S470);

KP air defense of the front (army) in the composition of the front-end anti-personnel systems KP tactical formation of the Air Defense Forces (countries); KP fighter aviation of the Air Force in the front (in the army).

The planning and organization of combat operations of the brigade was ensured on the basis of automatic and automated problem solving:

a) on interaction with the superior air defense command post (front or army):

receiving and documenting combat orders and orders from the air defense command post of the front (army); collecting, processing, storing, issuing to the specified air defense command post and displaying information on the status, condition, security and results of combat operations of the brigade; receiving from the specified air defense command alert signals and control commands; receiving and documenting information received from the said air defense command post on the position of the ground enemy, the actions of its aviation, the position and nature of the actions of the concealed troops, interacting formations and units of air defense forces of the air defense forces and air defense troops (of the country);

b) on interaction with subordinate units: collecting, processing and displaying data on the battle formations of divisions, a radar station and means of direct brigade cover; collecting, processing and displaying data on the readiness of subordinate units; collecting, processing and displaying data on the status and nature of actions of subordinate units ;

c) on making payments: the expected losses of enemy EFH; the expected expense of missiles; time for conducting marches and brigade movements; characteristics of brigade radar positions; the number of missiles required divisions, and the time of their submission to the destination.

In the ACS "Polyana-D4" to ensure the management of the combat work of the brigade in repelling the enemy's air attack, the following tasks were solved: automatic collection, processing and display of radar information; automatic issuance of selective alerts to subordinate divisions and the control point of the direct protection means; automated delivery of target designations to the command and control battalion from the front (army) air defense command post (up to two), prohibition firing at targets (up to five); automated distribution of divisional efforts in areas and heights; automated target distribution with the issuance of up to five target indications for each division and up to two targets for the control center for direct cover means; automatic decision-making during the actions of a brigade and fighters for the same purpose to destroy it by a brigade or fighters; automatic coordination of independent actions of divisions by targets in the area of overlap of affected areas; automated issuance of commands and reports of service character.

Technical means, algorithms and programs of the ACS provided: division management - up to four divisions; simultaneous display of up to 80 targets; processing and maintenance of up to 272 targets; simultaneous reception of radilokatsionny information from sources; selective notification of the KP of four divisions and points of control of means of direct protection - up to 20 targets each; simultaneous issuance of divisions and the control center for direct-covering means to 22 target designations and commands by targets, receiving and displaying reports on their execution; assigning zones (sectors) of responsibility to four divisions, receiving and displaying reports about their receipt; simultaneous reception and processing of two target indications, five prohibitions of firing and commands indicating the boundaries of areas of responsibility received from the air defense command post of the front (army), and issuing reports on them; receiving, displaying and documenting operational-tactical information about the ground situation - up to 200 objects.

These funds provided the opportunity to train combat crews with imitations of up to 50 targets and combat operations of two divisions and the air defense command post of the front (army).

ACS 9C52 implemented the principle of mixed combat control of an anti-aircraft missile brigade SZOOV or Buk, in which rationally combined centralized targeting of crews to brigade with autonomous actions of anti-aircraft missile divisions of choice of targets for firing in specified sectors and areas of responsibility.

In combat mode, decisions were developed continuously on the management of combat operations of the brigade, both automatically and with the participation of the operators, bringing them to subordinate units and monitoring implementation. The management of these units was provided primarily on the basis of the collection and processing of GTIs and radar images.

RLI about the air situation (VO) came from the air defense command post of the front or army (up to 20 targets tracks), from the PORI-PORI-P1 RLP (up to 50 tracks) or PORI-P2 (up to 30 tracks), from the A-50 aviation complex (to 60 routes), from four KP subordinate divisions (up to 24 routes from each), from the command center of fighter aviation of the front air force (up to 30 routes). The collection, processing, identification and mapping of this radar image was carried out on PBU. The goals were displayed on the indicators in the form of symbols that corresponded to their own, alien and unidentified goals, with a form containing the number of the goal, its height and quantitative composition. It was planned to display 5 trails of targets, extrapolated for a time up to 7 minutes. VO was displayed in six echelons of heights - from 0 to 12,800 m and more. The PBL of the brigade was managed with PBU, which allowed changing the

measurement rate of target coordinates, specifying their membership, etc. Selective notification of divisions and means of directly covering the brigade was automatically formed in accordance with the priority selection series of targets, which was also formed automatically based on the coordinates and parameters of movement of targets, their importance (danger) and the position of subordinate weapons.

OTI from the air defense command post of the front (army) came in the form of orders and instructions, information about the enemy, commands for the distribution of efforts, flight corridors and applications for flights of its aircraft, duty zones of fighter aircraft, coordinates of the front (army) reference point, information about the ground situation . The exchange of OTI between PBU and the air defense command post of the front (army) was carried out using FAS telecode channels with non-formalized text, formalized tables (codograms), signals of command and signal information (XI), graphic information plotted at the receiving sites on the map using drawing and graphic automata (ChGA). The possibility of introducing graphical information into the electronic computer complex (EBK) of the PBU in semi-automatic mode using the display and the graphic information retrieval device was provided. OTI was reflected in the workplaces of combat crew in PBU and KSHM. On the indicators and the electron-optical tablet (EOC), a combination of displays of the ground and air situation, including information on the actions of its aircraft, was provided.

Television sign board (TZT) displayed commands general (service) type, management team for the distribution of efforts, teams for goals, characteristics of goals. With the help of TZT and equipment of the automated workplace of the combat crew, the possibility of issuing commands to the EED for the necessary settlement operations, data entry and launch of the display programs was provided. Text information was documented on an alphanumeric printing device (ADC). If necessary, it could be displayed on the brigade commander's TZT.

According to the results of the collection and processing of GTIs and radar data, as well as data on the status and condition of subordinate fire units, they were managed to repel air raids and enemy ballistic missile strikes. This management included:

automated formation and transfer of command teams into divisional teams for the distribution of efforts in the form of sectors, areas of responsibility, missile-prone areas, receiving and displaying reports on their execution, forming control stations with the help of remote controls and sending control point coordinates to divisions; creating workstations with the use of consoles and transferring control teams of the general type to the control equipment of the divisions and the point of control of direct protection means (PU SNP), receiving and displaying reports on their execution; automatic or automated (with the participation of operators) the formation and transmission to the command and divisions and PU of the SNP teams by objectives, receiving and displaying reports on the progress and results of their implementation; continuous processing, issuance for display devices and input into the algorithms for target distribution and coordination of combat actions of divisions of data from the air defense command post of the front (army) and combat planes of the air force of the front air force (army) about the air situation with signs of actions on the IA and air defense missile systems, as well as reports from divisions on combat work on targets assigned from the command brigade and selected independently; automatic or manual input from the AWP consoles to the ACU of the AMS 9C52 data on the status, condition, combat readiness and nature of actions of subordinate units.

At the air defense command post, the Polyana-D4 automated control system transmitted reports on the status, state of combat readiness and results of combat operations of all combat assets of the brigade, on the implementation of commands for the objectives issued by this command post, on the distribution of the brigade’s efforts.

The standby mode provided for the operation of a limited number of technical means of the 9S52 ACS, which provided the reception of information about the air situation, warning signals and commands to bring brigade units to various levels of alert, control brigade duty units.

Tests

In the period from May 1985 to June 1986, a prototype of the automated control system "Polyana-D4" passed state tests, which were conducted under the guidance of a commission headed by S. D. Chubarev. The structure of this commission included N. S. Aksyutin, A. V. Sidorov, G. A. Burlakov, V. M. Blinov, A. P. Dergachev, Yu. Ya. Zotov, A. V. Irinchuk, K. A. Komarov, L. T. Sapega, V. I. Sokiran, N. N. Falev and other representatives of the USSR Ministry of Defense and Industry. A large group of employees from research organizations of the USSR Ministry of Defense and industry took part in the analysis of test results.

The tests were carried out in two stages. At the first stage, using the simulation-modeling complex (IMC), NIISA performed an assessment of the correctness of the software, performance, temporal and accuracy characteristics of the 9C52 ACS, as well as testing the possibilities of providing informational interface of the system with objects that have not yet been completed. At the second stage, conducted at the Embeni test site (the site director V. V. Unuchko, his deputy P. M. Opanasenko, the head of the lead department A. Ya. Belotserkovsky), the operational and technical characteristics of the system were evaluated in real conditions, its information technical interfacing with existing managed objects and communication facilities, field confirmation of the characteristics of the automated control system obtained using the NIISA IMC at the first stage of testing.

These tests confirmed that the system met the requirements of the TTZ and ensured more effective combat operation of the S-300V or Buk anti-aircraft missile brigade. As a result of modeling the brigade's combat operations in a complex air and jamming environment equipped with the Polyana-D4 automated control system, it was found that, compared with the autonomous actions of the brigade divisions, the number of enemy EIA hit by an S-300B brigade increases by 20-23%, and brigade "Buk-M1" - by 35-37%.

The creation of the Polyana-D4 automated control system was a new qualitative step in the direction of automating the control of anti-aircraft missile formations of the operational link of the military air defense. In terms of its performance characteristics, this system significantly exceeded the Polyana-D1 automated control system and, in general, had characteristics superior to those of the Missile Minder system used to control the air defense command and control system of NATO ground forces.

Characteristic differences between ASU 9S52 and AS "Polyana-D1" were the capabilities of the first automation system to organize and plan combat operations of anti-aircraft missile brigades, take account of the position and condition of the covered troops and more efficiently manage brigade fire by solving a number of information and design tasks using advanced general, systematic and special software, high-performance EHR, ARM and many more advanced sources of radar data.

The development of the AMS "Polyana-D4" was a great success of the developers and customers of the system, as well as the staff of military research institutes (3 research institutes of the Ministry of Defense and others), who developed operational-tactical tasks and algorithms of the system that carried out the military-scientific support of this development.

Adoption

In 1986, the AMS "Polyana-D4" was adopted by the Soviet Army - air defense forces of the Armed Forces.

Serial production of PBU, CSM and maintenance machines of this system was organized at the Minsk Electromechanical Plant NPO Agat of the Ministry of Radio Industry, and then transferred to the Penza Radio Plant of the Ministry of Radio Industry.

Modernization

1987-1990 system has been modernized. Basically, the modernization was reduced to the replacement of data transmission equipment (ADF) used in the telecode data exchange channels between the Poliana-D4 automated control system and the objects interfacing with it. ACS "Polyana-D4M" was equipped with an ADF from the set of Redut-2P equipment that was standardized for ASUV facilities. In 1990 , after passing tests at the Embeni test site (the site director V. V. Unuchko, his deputy G. G. Garbuz, the head of the leading department A. Ya. Belotserkovsky), the Polyana-D4M automated control system (9S52M) was put into service.